ES442 Prerequisites:  
Students must concurrently register for a research course (see instructor for an approved list), or have prior research experience, or receive permission from instructor. Junior standing required. By permission of instructor.

ES542 Prerequisites:  
Graduate standing

Text:  
See Moodle for references and resources

Instructors:  
Kathleen A. Issen, issenka@clarkson.edu, 315-268-3880, 207 CAMP  
Sitaraman Krishnan, skrishna@clarkson.edu, 315-268-6661, 229 CAMP  
Narayanan Neithalath, nneithal@clarkson.edu, 315-268-1261, 126 Rowley  
Stephanie A. Schuckers, sschucke@clarkson.edu, 315-268-6536, 136 CAMP

Class Times:  
Mondays, 5:30 – 6:20, 177 CAMP

Office Hours:  
Contact individual instructors for office hours, or see Moodle.

Objectives
1. Introduce students to fundamental research and graduate study skills, methodologies and processes.
2. Provide an introduction to research-related career paths.

Program Outcomes
Students will be able to:
1. Conduct literature searches and write a literature review
2. Write and review research proposals and research papers
3. Create and deliver technical presentations
4. Understand introductory concepts of experimental design and statistical data analysis
5. Identify ethical perspectives in engineering and science

Policies
1. Assignments are due at the beginning of class unless otherwise announced. Assignments turned in late, but within one week of the due date will receive a 50% deduction. Assignments turned in more than a week late will receive no credit.
2. Students are expected to attend all lectures, complete pre-lecture reading assignments and participate actively in the workshops. During workshops and presentations, students are expected to interact in a professional manner and provide thoughtful, useful feedback to their peers via critique forms and questions.

Grading
Scores calculated using the percentages below will give you a grade of A if you obtain 90% or above, B+ is 85% or above, B is 80% or above, C+ is 75% or above, C is 70% or above, D+ is 65% or above, and D is 60% or above. Below 60% will be assigned a letter grade of F. For more information, see Grading Procedures document.

20% Class attendance
20% Workshop participation and peer reviews
60% Major assignments
10% Technical presentation
25% Final paper presentation*
25% Final paper*

* The student and his/her research advisor will select the type of final paper: 1) literature review, or 2) research proposal, or 3) research results paper. The final presentation is on the final paper.

**Major Assignment Due Dates**
Technical presentation: Day 8, October 19th
Final presentation: Day 14, November 30th
Final paper due: Monday, 6th

**Topic Outline**
For more information see Class Schedule document.

- Day 1: Course Overview
- Day 2: Conducting a Literature Search
- Day 3: Writing a Literature Review
- Day 4: Writing a Research Proposal
- Day 5: Design of Experiments
- Day 6: Reviewing Research Proposals (workshop; peer review of proposals)
- Day 7: Preparing a Technical Presentation
- Day 8: Technical Presentations (students give presentations)
- Day 9: Statistical Analysis of Data
- Day 10: Writing a Research Paper
- Day 11: Research Ethics
- Day 12: Delivering Technical Presentations
- Day 13: Reviewing Research Papers (peer review of research papers)
- Day 14: Final Paper Presentations (students give their final paper presentations)
- Finals week: Final research paper due on Monday

**Writing Standards**
1. All written assignments, in particular the literature review, research proposal and research paper, must use 12 point Times New Roman font, 1 inch margins all around and single spaced. These are the standards commonly required by funding agencies, journals and technical conferences.
2. Page length requirements for written assignments are given below. Shorter documents will be penalized. Slightly longer documents will be accepted, but excessively long documents (except for the literature review) will be penalized, since most funding agencies, journals and conference proceedings have strict page limits.
   - a. Literature review: 3-5 pages (no penalty for longer documents)
   - b. Research proposal: 2-3 pages (similar to a white paper)
   - c. Final research paper: 4-6 pages (similar to a conference proceedings style paper)
3. Written assignments should be reviewed and critiqued by your research advisor, and then redrafted by you, before submitting to this class.
4. Assistance with fundamental writing skills can be obtained at the Clarkson Writing Center, www.clarkson.edu/writingcenter, 315-268-4439, wcenter@clarkson.edu.
<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
<th>Format</th>
<th>Instructor (tentative)</th>
<th>Assignment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug 23</td>
<td>Course Overview</td>
<td>Lecture</td>
<td>K. Issen</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Aug 30</td>
<td>Conducting a Literature Search</td>
<td>Lecture</td>
<td>R. DeFranza</td>
<td>Student info sheet (name, major, research advisor, research topic)</td>
</tr>
<tr>
<td>3</td>
<td>Sep 6</td>
<td>Writing a Literature Review</td>
<td>Lecture</td>
<td>S. Krishnan</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sep 13</td>
<td>Writing a Research Proposal</td>
<td>Lecture</td>
<td>S. Schuckers</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sep 20</td>
<td>Design of Experiments</td>
<td>Lecture</td>
<td>W. Wilcox</td>
<td>Proposal review teams: names of 3-5 students and proposal title you will review</td>
</tr>
<tr>
<td></td>
<td>Sep 27</td>
<td>No Class: Fall Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Oct 4</td>
<td>Reviewing Research Proposals</td>
<td>Workshop</td>
<td>Issen/Krishnan/Neithalath/Schuckers</td>
<td>At end of class: Team evaluation sheets for proposal review</td>
</tr>
<tr>
<td>7</td>
<td>Oct 11</td>
<td>Preparing a Technical Presentation</td>
<td>Lecture</td>
<td>N. Neithalath</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Oct 18</td>
<td>Technical Presentations 5:30 - 7:30PM</td>
<td>Student Presentations</td>
<td>Issen/Krishnan/Neithalath/Schuckers</td>
<td>At end of class: Peer evaluation sheets for student presentations</td>
</tr>
<tr>
<td>9</td>
<td>Oct 25</td>
<td>Statistical Analysis of Data</td>
<td>Lecture</td>
<td>W. Wilcox</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Nov 1</td>
<td>Writing a Research Paper</td>
<td>Lecture</td>
<td>K. Issen</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Nov 8</td>
<td>Research Ethics</td>
<td>Lecture</td>
<td>L. Kuxhaus</td>
<td></td>
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<tr>
<td>12</td>
<td>Nov 15</td>
<td>Delivering Technical Presentations</td>
<td>Lecture</td>
<td>TBD</td>
<td>First draft of final paper due (post on Moodle)</td>
</tr>
<tr>
<td>13</td>
<td>Nov 22</td>
<td>Reviewing Research Papers</td>
<td>No Class</td>
<td></td>
<td>Peer evaluation sheets for student first draft papers (due at noon in drop box)</td>
</tr>
<tr>
<td>14</td>
<td>Nov 29</td>
<td>Final Paper Presentations 5:30 - 7:30PM</td>
<td>Student Presentations</td>
<td>Issen/Krishnan/Neithalath/Schuckers</td>
<td>At end of class: Peer evaluation sheets for student presentations</td>
</tr>
<tr>
<td>15</td>
<td>Dec 6</td>
<td>No Class</td>
<td></td>
<td></td>
<td>Final paper due today</td>
</tr>
</tbody>
</table>
I. Class Attendance: 20%
10 Lectures; grading based on attendance: 10 = attended, 0 = missed
Note: the 2 workshop classes and 2 presentation classes are graded in II and III below

II. Workshops and Peer Reviews: 20%
Each session is graded out of 10 based on participation in group discussions (graded 0-5) and providing useful comments on critique sheets (graded 0-5)
   a. Day 6: Evaluation sheets for peer review of PhD proposals
   b. Day 8: Evaluation sheets for peer review of technical presentations
   c. Day 13: Evaluation sheets for peer review of first draft papers
   d. Day 14: Evaluation sheets for peer review of final presentations

III. Major Assignments: 60%
Each item is graded out of 10 using critique sheets completed by course instructors. See below for page length requirements and writing standards.
   a. Day 8: Technical presentation: 10%
   b. Day 14: Final presentation: 25%
   c. Day 15 (finals week): Final paper: 25%

Note: For final paper, students have a choice of:
   a) Literature review
   b) Research proposal
   c) Research results paper
The final presentation will be on the final paper content.

Writing Standards
1. All written assignments must use 12 point Times New Roman font, 1 inch margins all around and be single spaced. These are the standards commonly required by funding agencies, journals and technical conferences.
2. Page length requirements for written assignments are given below. Shorter documents will be penalized. Slightly longer documents will be accepted, but excessively long documents (except for the literature review) will be penalized, since most funding agencies, journals and conference proceedings have strict page limits.
   a. Literature review: 3-5 pages (no penalty for longer documents)
   b. Research proposal: 2-3 pages (similar to a white paper)
   c. Final research paper: 4-6 pages (similar to a conference proceedings style paper)
3. Written assignments should be reviewed and critiqued by your research advisor, and then redrafted by you, before submitting to this class.
4. Assistance with fundamental writing skills can be obtained at the Clarkson Writing Center, www.clarkson.edu/writingcenter, 315-268-4439, wcenter@clarkson.edu.
Approved Undergraduate Research Courses

I. Undergraduate students conducting research (either for-credit, paid, or on a volunteer-basis) should enroll in one of the approved undergraduate research courses listed below. Department special project courses or independent study courses should no longer be used for research.

II. The undergraduate research course, *ES442 Fundamentals of Research and Graduate Study*, requires that “Students must concurrently register for a research course (approved list available in the office of the Dean of Engineering), or have prior research experience, or receive permission from instructor.” Below is the approved list of research courses that satisfy this requirement.

- CH390 Undergraduate Research Project (1-4 cr.)
- CH391 Undergraduate Research Project (1-4 cr.)
- CH392 Undergraduate Research Project (1-4 cr.)
- CH393 Undergraduate Research Project (1-4 cr.)
- CH394 Undergraduate Research Project (1-4 cr.)
- CH395 Undergraduate Research Project (1-4 cr.)
- ES243 Introductory Undergraduate Research I (1-4 cr.)
- ES244 Introductory Undergraduate Research II (1-4 cr.)
- ES443 Undergraduate Research I (1-4 cr.)
- ES444 Undergraduate Research II (1-4 cr.)
- ES445 Undergraduate Research III (1-4 cr.)
- ES446 Undergraduate Research IV (1-4 cr.)
- ES147 First Year Research Experience (0 cr.)
- ES247 Sophomore Research Experience (0 cr.)
- ES347 Junior Research Experience (0 cr.)
- ES447 Senior Research Experience (0 cr.)
- HP390 Honors Undergraduate Thesis (1-10 cr.)
- HP391 Honors Undergraduate Thesis (1-10 cr.)
- HP490 Honors Undergraduate Thesis (1-10 cr.)
- HP491 Honors Undergraduate Thesis (1-10 cr.)

Questions should be directed to:
- CSoE Undergraduate Research Committee
  K. Issen, MAE, Chair
  S. Krishnan, CBE
  N. Neithalath, CEE
  S. Schuckers, ECE

Created: March 20, 2009; Revised August 17, 2009.
Fundamentals of Research and Graduate Study: Literature Review

Sitaraman Krishnan
Assistant Professor
Department of Chemical & Biomolecular Engineering
Objectives of Academic Research and Graduate Study (Davis and Parker, 1997)

• Make a contribution to knowledge through independent study
• Document the research and make it available to scholarly community
Selection of Advisor and Topic of Research

- Identify your area of interest within an academic field
- Find an advisor whose research interests are in similar or related topics
- Advisor mentors and guides the student in research
  - helps in formulating the thesis statement
  - trains the student in experimental methods
  - reads and comments on thesis documents
Thesis Statement

• Thesis statement is a claim that can be proved with experimental evidence.
  – the question your project is answering.

• Literature review (and your research advisor) help you formulate the thesis statement for your research.
The context of your work:

Your broad research interest

Your specific interest

The question your project is answering

Examples of research topics from the Krishnan group:

**Solar cells**
- The design and synthesis of novel polymer electrolytes for dye-sensitized solar cells

**Anti-biofouling coatings**
- The design and synthesis of novel functional polymers that can resist adsorption of proteins and adhesion of cells

How does the chemical structure of the polymer affect ion conductivity, and the power conversion efficiency of the device?

What is the effect of charge and charge distribution in the polymer microstructure, on protein adsorption and cell adhesion?

Adapted from Holtom & Fisher (1999)
### SciFinder Explore References

#### Research Topic:
- **Research Topic:** solar cells
- **Examples:**
  - The effect of antibacterial resins on dairy products
  - Photodimerization of aromatic compounds

#### Publication Year(s)

#### Document Type(s)
- Biography
- Book
- Clinical Trial
- Commentary
- Conference
- Dissertation
- Editorial
- Historical
- Journal
- Literature Review
- Preprint
- Patent
- Report
- Letter

#### Language(s)
- Chinese
- English
- French
- German
- Italian
- Japanese
- Polish
- Russian
- Spanish

#### Author Name
- **Last Name:**
- **First Name:**
- **Middle Name:**

#### Company Name
- **Examples:**
  - Minnesota Mining and Manufacturing
  - DuPont
163,038 references!
Refine by:

Research Topic: Polymer electrolytes for dye-sensitized solar cells
Literature Review

• The exercise of reviewing the literature is based on the assumption that we learn from and build on what others have done.

• Purpose of writing a literature review:
  – To demonstrate a familiarity with a body of knowledge and establish credibility. A good review increases the reader’s confidence in the researcher’s professional competence, ability, and background.
  – To show the path of prior research and how a current project is linked to it.
  – To integrate and summarize what is known in an area. Pulls together and synthesizes different results. Provides a taxonomy and indicates directions for future research.
  – To learn from others and stimulate new ideas. Suggests hypotheses for testing. Helps other and future researchers to not “re-invent the wheel.”

• Source: Professor Linda W. Friedman’s Guide to Writing the Literature Review Survey Paper
Literature Review

• The review of literature helps in:
  – Formulating a thesis statement
  – Planning research methodology
  – Anticipating potential outcomes

• First, familiarize yourself with the background material
  – Text books, reference books

• Then, search for existing literature using Scientific Databases
Example of Application of Literature Review in Planning Research

• *Hypothesis*: Ion conductivity of a polymer can be related to the chemical microstructure and viscoelasticity of the polymer. By engineering the microstructure and viscoelasticity of the polymer electrolytes, high-efficiency dye-sensitized solar cells can be obtained.

• Collect and organize evidence (from the 375 references).

• Look for relationships between polymer structure and ion conductivity.

• Think about the significance of these relationships.

• Identify areas where further research is needed.
375 References! Where to begin?

1. Research peer-reviewed publications and review articles written by key researchers in the field.
   • seminal ideas/papers in the field
2. Papers published during the past five years.
3. The references in these publications.
4. Papers citing these publications.
Finding Articles Using Databases

- http://clarkson.edu/library/journals/databases.html
  - Web of Science
  - Science Direct
  - PubMed (Chemical, Electrical, Materials, Mechanical Engineering research related to Medicine)
  - SciFinder Scholar (Chemical & Materials Engineering)
  - Civil Engineering Database (Civil Engineering)
  - IEEE Journals (Electrical Engineering)
  - ASME Journals (Mechanical Engineering)
  - Wiley Journals
  - RSC Journals (Chemical & Materials Engineering)
  - Google scholar
Subject:
- All Sciences – Chemical Engineering
  - Computer Science
  - Energy
  - Engineering
  - Environmental Science
  - Materials Science
  - Science
  - Mathematics
  - Medicine and Dentistry
  - Neuroscience
  - Physics and Astronomy
Civil Engineering Database

ASCE’s Electronic Information Retrieval Service to All Its Publications

Provides access to over 100,000 bibliographic and abstracted records. Current coverage: 1970 - Present

To start your search, enter one or more words for each category you are interested in. For help, click on the name of the field(s) you want to use.

**Document Type**
- all document types

**Serial Title**
- all titles

**All Text Fields**
- all titles

**Author**

**Title**

**Subject Headings**

**Year Range**
- Start Year: 
- End Year: 

[Search] [Reset]
Who are the key researchers in the field?
Research Topic: solar cells

Refine by:

Research Topic: Dye-sensitized solar cells

5770 references
Research Topic: solar cells

Refine by:

Research Topic: Dye-sensitized solar cells

5770 references

Analyze by:

Author Name

M. Grätzel 277
A. Hironori 157
Research Topic: solar cells

Refine by:

Research Topic: Polymer electrolytes for dye-sensitized solar cells

375 references

L. Yuan 22
F. Shibi 19
Example of a Recent Review Article by a ‘Key Researcher’ in the Field

Recent Advances in Sensitized Mesoscopic Solar Cells

MICHAEL GRATZEL*

Laboratory of Photonics and Interfaces, Institute of Chemical Science and Engineering, Faculty of Basic Science, Ecole Polytechnique Federale de Lausanne, CH-1015 Lausanne, Switzerland

RECEIVED ON MAY 3, 2009

CON SPECTUS

Perhaps the largest challenge for our global society is to find ways to replace the slowly but inevitably vanishing fossil fuel supplies by renewable resources and, at the same time, avoid negative effects from the current energy system on climate, environment, and health. The quality of human life to a large degree depends upon the availability of clean energy sources. The worldwide power consumption is expected to double in the next 3 decades because of the increase in world population and the rising demand of energy in the developing countries. This implies enhanced depletion of fossil fuel reserves, leading to further aggravation of the environmental pollution. As a consequence of dwindling resources, a huge power supply gap of 14 terawatts is expected to open up by year 2050 equaling today’s entire consumption, thus threatening to create a planetary emergency of gigantic dimensions. Solar energy is expected to play a crucial role as a future energy source. The sun provides about 120,000 terawatts to the earth’s surface, which amounts to 6000 times the present rate of the world’s energy consumption. However, capturing solar energy and converting it to electricity or chemical fuels, such as hydrogen, at low cost and using abundantly available raw materials remains a huge challenge. Chemistry is expected to make pivotal contributions to identify environmentally friendly solutions to this energy problem. One area of great promise is that of solar converters generally referred to as “organic photovoltaic cells” (OPV) that employ organic constituents for light harvesting or charge carrier transport. While this field is still in its infancy, its rapid progress around the corner with the number of effective organic materials ever increasing...
How to Read a Research Paper

• Locate the Thesis Statement
  – Thesis statement is the authors’ point of view on the topic
  – It tells the reader what to expect from the rest of the paper
  – Is usually a single sentence somewhere in the first paragraph that presents the researcher’s argument to the reader.
  – The rest of the paper, the body of the essay, gathers and organizes evidence that will persuade the reader of the logic of interpretation by the authors of the paper.
  – See [UNC Writing Center](https://unc.writingcenter.org) for more information on Thesis Statements.
How to Read a Research Paper

- Analyze the Paper
  - What is the author’s main point?
  - What is the author’s purpose?
  - Who is the author’s intended audience?
  - What arguments does the author use to support the main point?
  - What evidence does the author present to support the arguments?
  - What are the author’s underlying assumptions or biases?

Source: Susan Katz and Jennie Skerl, Writing Center at RPI on writing a critique.
Writing a Literature Review

• Find the focus – usually the common point in your sources
  – Construct a “thesis statement” for your review article
  – The thesis statement should be related to the thesis statement for your research project

• Find Models
  – Look for other literature reviews in your area of interest or in the disciple and read them.

See UNC Writing Center for more information.
Example: Thesis Statement in Grätzel’s Review

• The research discussed within the framework of this Account aims at identifying and providing solutions to the efficiency problems that the OPV field is still facing. The discussion focuses on mesoscopic solar cells, in particular, dye-sensitized solar cells (DSCs), which have been developed in our laboratory and remain the focus of our investigations. The efficiency problem is being tackled using molecular science and nanotechnology.
turing solar energy and converting it to electricity or chemical fuels, such as hydrogen, at low cost and using abundantly available raw materials remains a huge challenge. Chemistry is expected to make pivotal contributions to identify environmentally friendly solutions to this energy problem. One area of great promise is that of solar converters generally referred to as “organic photovoltaic cells” (OPV) that employ organic constituents for light harvesting or charge carrier transport. While this field is still in its infancy, it is receiving enormous research attention, with the number of publications growing exponentially over the past decade. The advantage of this new generation of solar cells is that they can be produced at low cost, i.e., potentially less than 1 U.S. $/peak watt. Some but not all OPV embodiments can avoid the expensive and energy-intensive high vacuum and materials purification steps that are currently employed in the fabrication of all other thin-film solar cells. Organic materials are abundantly available, so that the technology can be scaled up to the terawatt scale without running into feedstock supply problems. This gives organic-based solar cells an advantage over the two major competing thin-film photovoltaic devices, i.e., CdTe and CuIn(As)Se, which use highly toxic materials of low natural abundance. However, a drawback of the current embodiment of OPV cells is that their efficiency is significantly lower than that for single and multicrystalline silicon as well as CdTe and CuIn(As)Se cells. Also, polymer-based OPV cells are very sensitive to water and oxygen and, hence, need to be carefully sealed to avoid rapid degradation. The research discussed within the framework of this Account aims at identifying and providing solutions to the efficiency problems that the OPV field is still facing. The discussion focuses on mesoscopic solar cells, in particular, dye-sensitized solar cells (DSCs), which have been developed in our laboratory and remain the focus of our investigations. The efficiency problem is being tackled using molecular science and nanotechnology. The sensitizer constitutes the heart of the DSC, using sunlight to pump electrons from a lower to a higher energy level, generating in this fashion an electric potential difference, which can exploited to produce electric work. Currently, there is a quest for sensitizers that achieve effective harnessing of the red and near-IR part of sunlight, converting these photons to electricity better than the currently used generation of dyes. Progress in this area has been significant over the past few years, resulting in a boost in the conversion efficiency of the DSC that will be reviewed.
Structure of a Review Article

- The review should consist of paragraphs that are organized according to themes.
- The review should not be a list that merely summarizes one citation after another.
- Each paragraph should, preferably, begin and end with your own discussion or interpretation.
Standard Format

• An introduction to the topic of the review article
• A body (prose) consisting of paragraphs labeled with headings and subheadings
• A conclusion with recommendations for further research
• A list of literature cited (the reference section)
Introduction

• Define or identify the topic, thus providing an appropriate context for reviewing the literature.

• Point out overall trends in what has been published about the topic
  – conflicts in theory, methodology, evidence, and conclusions;
  – gaps in research and scholarship;
  – new perspective of immediate interest.

• Establish the writer’s reason (point of view) for reviewing the literature
  – explain the criteria to be used in analyzing and comparing literature
  – explain the organization of the review (sequence);
  – When necessary, state why certain literature is or is not included (scope)

• Source: The Writing Center, University of Wisconsin
Body

• Summarize individual studies or articles with a level of detail that is proportional to the impact of the study on the field (which is evident from, for example, the number of times a paper has been cited by other researchers)

• In assessing each source, consider the following points:
  – Are the arguments sufficiently supported by experimental evidence?
  – Are there data in the literature that contradict the authors’ point?
  – What are the critical strengths and weaknesses of the paper?
  – Does the work make a significant contribution to the field, or is the contribution only minor?

• Provide the reader with “so what” summary sentences at intermediate points in the review to aid in understanding comparisons and analyses.

• Source: The Writing Center, University of Wisconsin
Conclusion

• Summarize major contributions of the reviewed articles, to the body of knowledge under review, maintaining the focus established in the introduction.
• Evaluate the current “state of the art” for the body of knowledge reviewed
• Point out major gaps in research, inconsistencies in theory and findings, and areas or issues pertinent to future study.
• Provide some insight into the relationship between the central topic of the literature review and a larger area of study such as a discipline, a scientific endeavor, or a profession.

• Source: The Writing Center, University of Wisconsin
The review should:

- Be organized around and directly related to a research problem/question you are thinking of developing;
- Organize and synthesize the findings of previous researchers into a summary of what is and is not known;
- Identify areas of controversy in the literature;
- Formulate questions that require further research.

Source: Professor Linda W. Friedman’s Guide to Writing the Literature Review Survey Paper
The review should:

• **Summarize and synthesize source materials**

• **Summary** – recap of the important information of the source

• **Synthesis** – re-organization, or re-shuffling, of that information
  – Gives new interpretation of old material
  – Combines new with old interpretations
  – Traces the progression of the field, including major debates
  – Evaluates the sources and advises the reader on the most pertinent or relevant.

• **Source:** [The Writing Center, University of North Carolina](https://writingcenter.unc.edu)
Writing the Literature Review

• Use evidence
  – Your interpretation of the available sources must be backed up with evidence to show that what you are saying is valid.

• Be selective
  – Select only the most important points in each source to highlight in the review.

• Summarize and synthesize the sources

• Use quotes sparingly
  – Try to rewrite what the author said in your own words (paraphrase)

• Keep your own voice
  – Start and end paragraphs with your own ideas and your own words. The sources should support your interpretation.

• Source: UNC Writing Center
Paraphrasing

• Paraphrasing means taking another person’s ideas and putting those ideas in your own words.

• Paraphrasing is a fine way to use another person’s ideas to support your argument as long as you attribute the material to the author and cite the source in the text at the end of the sentence.

• Be sure to represent the author’s information or opinions accurately and in your own words.

• If the ideas you are mentioning are not yours, make this clear.

• Use caution when paraphrasing  
  – Paraphrasing does not mean changing a word or two in someone else’s sentence, changing the sentence structure while maintaining the original words, or changing a few words to synonyms.

• Source: The Writing Center, University of North Carolina
How to Avoid Plagiarizing?

- Plagiarism: deliberate or reckless representation of another’s words, thoughts, or ideas as one’s own without attribution
- You have to cite your source even if:
  - You put all direct quotes in quotation marks.
  - You changed the words used by the author into synonyms.
  - You completely paraphrased the ideas to which you referred.
  - Your sentence is mostly made up of your own thoughts, but contains a reference to the author’s ideas.
  - You mention the author’s name in the sentence.
- “When in doubt, give a citation.”
- Source: The Writing Center, University of North Carolina
Revise

- Present your information in the most concise manner possible.
- Use terminology familiar to your audience; get rid of unnecessary jargon or slang.
- Double check that you have documented your sources and formatted the review appropriately for your discipline.

- Source: [UNC Writing Center](https://unc.edu/writing-center)
Writing a Review is Similar to Conducting an Experiment

• …A thought experiment
• Collect source articles/references ≡ data collection
• Read the sources and provide your outlook on the topic ≡ analysis
• The differences is that in writing a research paper one reports a new fact, but in a review paper one should report a new outlook in the field